MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EEM2046 – ENGINEERING MATHEMATICS IV

(RE / TE)

15 OCTOBER 2016
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of six pages including cover page with five questions only.

2. Attempt any **THREE** sub-questions from SECTION A and **ALL** questions from SECTION B. The distribution of the marks for each question is given.

3. Please write down all your answers in the answer Booklet provided. Show all relevant steps to obtain maximum marks.

Section A (30 marks)

Choose any THREE sub-questions. Each sub-question is 10 marks.

Question 1a

i) Given the complex function

$$f(z) = z^2 + \bar{z} + 1 .$$

Decompose $f(z)$ into its real and imaginary parts.

ii) Evaluate $\lim_{z \to 1} \dfrac{z^3 + z^2 - z - 1}{\sin(\pi z)}$.

[4+6 marks]

Question 1b

i) Find the derivatives of $f(z) = \dfrac{e^z}{z+1}$ and $g(z) = e^z(z+1)$.

ii) Given the complex function

$$f(z) = \begin{cases} \dfrac{z^2 + 3z + 2}{z^2 + 4z + 3}, & z \neq -1 \\ 1, & z = -1 \end{cases}$$

Is the complex function continuous at $z = -1$?

[4+6 marks]

Question 1c

Show that the complex function

$$f(z) = x^2 y + i y^2 x$$

is only differentiable at the origin by using Cauchy-Riemann Equations.

[10 marks]

Continued...

Question 1d

By using parameterization method, evaluate the contour integral

$$\int_C (x^2 + y)dz$$

where C is the straight line segment from $z = 0$ to $z = 2$.

[10 marks]

Question 1e

By using Cauchy's Integral Formula, evaluate

$$\int_\gamma \frac{1}{(z-1)^2(z+2)} dz$$

where γ is the positively oriented circle given by

i) $|z-1| = 1$

ii) $|z+2| = 2$

[Note: Please identify the singular point first.]

[5+5 marks]

Continued...

Section B (70 marks)

Answer ALL the questions.

Question 2 (15 marks)

a) The probability mass function of a random variable X is given by

$$f_X(x) = \begin{cases} \frac{x}{6}, & x = 0,1,2,3 \\ 0, & otherwise \end{cases}$$

Find the probability distribution of the random variable Y given by the transformation $Y = X^2$.

[6 marks]

b) Suppose that the probability mass function of a random variable Y is given by

$$f_Y(y) = ky^2, \qquad y = 1,2,3$$

Find k.

[5 marks]

c) The probability mass function of a random variable Z is given as follows:

$$f_Z(0) = f_Z(3) = \frac{1}{3} \text{ and } f_Z(1) = f_Z(2) = \frac{1}{6}.$$

Find the mean, μ_Z.

[Note: The mean is also called the first moment about the origin]

[4 marks]

Continued...

Question 3 (15 marks)

The probability transition matrix P of a discrete-time Markov Chain with state space {1,2,3} is given by

$$P=\begin{bmatrix} 0 & a & c \\ b & b & c \\ c & 0.2 & 0.3 \end{bmatrix}$$

a) Find the values of a, b, and c.

b) Draw the state transition diagram.

c) Find the two-step probability transition matrix, P^2.

d) Decompose the chain into equivalent classes.

e) Find the periodicity of state 2. Is state 2 periodic or aperiodic?

[3+4+4+1+3 marks]

Question 4 (20 marks)

A maximisation Linear Programming (LP) problem at Iteration 0 is as depicted in tableau below.

Basic	z	x_1	x_2	s_1	s_2	s_3	Solution
z	1	-2	1	0	0	0	0
s_1	0	5	2	1	0	0	5
s_2	0	1	-1	0	1	0	2
s_3	0	-1	1	0	0	1	2

a) Write down the standard form of the LP problem.

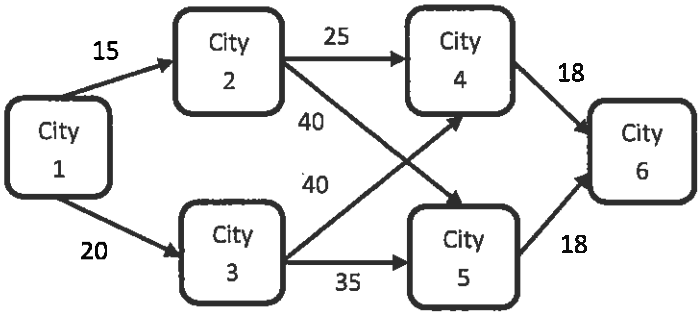
b) Compute Iteration 1 of the tableau by using Simplex Iteration Method. State the entering and leaving variables, optimal value and optimal solution.

[6+14 marks]

Continued...

Question 5 (20 marks)

By using dynamic programming (DP), find the shortest route from City 1 to City 6 as shown in the graph below. Assume all the distances to be in km.



Note:

a) write down the recursive formula of the DP problem.

b) show detailed steps.

[5+15 marks]

End of Paper